

EOS, TRANSACTIONS, AMERICAN GEOPHYSICAL UNION

#### Particles and Flelds... lonosphere

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F. M. Lacis (Gaster for Atsempheria and Spars Reitness, Brah State Usinsrairs, Logan, Ursh Etliy) J. C. forter and J. E. Boopath.

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VOL. 62, NO. 27, PAGES 589-576

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J. Samphye. Res., Edua, Paper 140931

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IONOSPERIC ECHTILIATION OSSERVATIONS AT MATAL
S.C. Teb (Department of Electrical Englessing,
University of Illinois, Urbana, IL (1801, U.S.A.)
J.F. Mailec, J.E. Medairos, S.F. de Siiva and
S.T. Medairos

J.F. Mullec, J.E. Medairos, E.F. de Siive end
E.T. Medairos
Le this paper ve capoct lonespherio acintiliatios observations made at Setal, Steali during a
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a typical behavior for the South Americes sactor
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of 278 enters, the easteard irregularity drift
spend was samured by the method of sinilar
index. This together with the detarmination of
Frescal irregeamy from the power spectrum semiyals was used to televiste the height of the irtegularity patch. A value of 294 km can obtainals was used to calculate the height of the irteguiarity patch. A value of 294 we associate
ad. Multi-satellite cointillation observations
indicated that awas though the lolitation of an
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ihare eats substantial cases when the coveres was
observed. One cose which can emalysed in datail
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\$2.5 (matter). J. Gacahye, Rus., Slue, Paper 140611

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THE OCCUMENCE OF SIGNITIES OF SCRIFF ATIONS HEAR EQUATORIAL MONALY CREST IS THE INDIAN SECTOR

A. GasCopts (Air Force Geophysine Leboratory/PRT, hearco Air Force Sees, MA 01711) A. Fritta and Sections Hear of S

### Particles and Fields-Magnetosphere

3715 Electris fields
AN EL-1 STARCH FOR CONFINES RECIONS OF LABEE
PARALLEL SECTRIC PIELDS
H. S. Bookm (Space Sciences Laboretory and Physics
Department, University of Casifornie, Strictly,
Califorcia 947209 F. S. Hoest
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shocks).

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FIRE Please instabilities
THE BIGHTFICANCE OF TEMPERATURE IN A FINITE
SECRETAT BEAN-YLASMA SYSTEM
R. J. Scraogeney (Cooperative Institute for
Seasecoh in Environmental Stimmes, Enivertil
of Coloredo/Nola, Boulder, CO 80309)

Samecch in Environmental Sylumes, iniversity of Coloredo/Hold, Boulder, CO 80109)

A cold plasma approximation is often explored whee deriving a wate dispersion caletion for a whee deriving a wate dispersion caletion for a bear-plasma system in which the bear width is constituted to the approximation say no longer he wild fot a middled to he a faster in the bear widel is constituted in the approximation say no longer he wild fot a midficiently this bear whose widel is constituted in the angles. As an islital attention to the temperature are an irrat order extract the into secount earn plasma affects we areast take into secount earn plasma affects we areast and dispersion testion. The presented deputed wave fields are found for solutions in the following field early found in the first second of the second of the solutions of the second of the solution gives frequency in greeter than the electron gives frequency. Hone temperature sets as a confrequency of the second of the wave field and the temperature both fine cold model fields and the temperature according to the second of th

# Looking for a Change of Climate? Computers Make Long-Time Comparisons Possible

C. J. Posey

University of Connecticut, Storrs

with the increasing mobility of our population, climate is secoming more of e factor in deciding where to look tor a New job or a good place for relirement. It e new location ems out to be no improvement, the young can try enother one. The elderly must be more careful. The place they liked best during vacatione mey not be eo good during the rest

By noticing news medie reports of temperatures and precolletton, one can gain some idea of the weather at various locations in the United States. To take into eccount the many other elemente that affect individual preferences, triel residence for a whole year would seem to be necessery idificult to arrange tor most of us). Even this might not be mough, for there are both good years and bed years av-

There is a wideepread beliet that certain creas of the country have a more equable climete than othere. To stlad people who dislike repid temperature changes, some localities cleim to have the most equable climete enywhere. To see how great the differences can be, we selected two iles for which the contrast should be extreme: Minnespois and San Francisco. Minneapolis le near the middle of the great North American plain, while San Francisco is on he edge of the vast expanse of the Pecific Ocean. Recerds of Fahrenheit thermometer reedinge taken hourly et hese siallone for the 10 years from Jenuary t, 1949, to December 31, 1959, were syalleble to provide the data for an objective comparison. The 87,600 readings at each sta-

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Cover. The May 18, 1980, eruption of Mt. St. Helene was observed by SWIR aeneors abound two U.S. Air Force salellitee. The data reveal a complex ecquence of evente tollowing initiation of the Proprior of 8:32 PDT (15:32 UT), as described on page 577 of this Issue. Immediately following the triggering landelide, a large cloud of ash was propelled toward the east and northeest at a speed of about 100 m/e, while hotter material was being evolved along the north flank of the mountain. The figures on the cover delineate the largest leterel blest, which began at ebout 15:34:50 UT, about 21/2 in into the eruption. The eurge moved northward elong the track shown in the left tigure (lack marks al 10-km intervels). The boundary of the zone of destruction is shown for orientation. The two figures to the right show the distance traveled (top) and the speed of the aurge as a function of time. The initial velocity was about 45 me aurge as a function of time. The initial velocity was about 450 m/s. The fen shaped surge split the previously evolved as into two parts, propelling them eastward and weetward at velocities of 150–250 m/s. Emission of extramely hot sen at the crailer lisely the control of th ler iself was lerminated with the blast end did not resume until 6-7 min between the common of the c min later, at which time copioue vertical emission began. (For more information, see news item, pg. 577.)

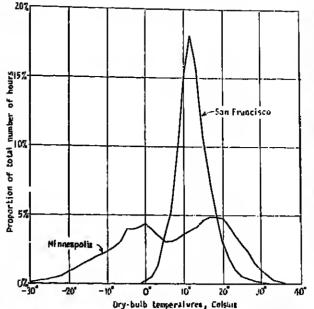


Fig. 1. Frequency of various temperatures, as recorded hourly during 10-year period 1949-1959. (Lines connect points plotted et centers of class intervals 3° F wide.)

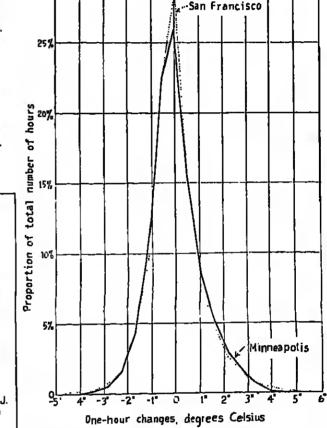


Fig. 2. Frequency of hour-to-hour temperature changes. (Lines connect points plotted at centere of 1° F cless intervele.)

tion were enelyzed with the eid of the University of Connecticut's digitel computer

The seasonal renges of iempereture for both stetions ere shown on Figura 1. Those who suffer when tempereturee go below freezing will seldom be discomforted in Sen Frencisco, while those who remein in Minneapolis will experience euch temperatures more than one third of the time. On the other hend, Minneepolls has temperatures ebove 18° C (85° F), necessery for growing certain crops, naarly three times es many hours ee does San Francisco. Study ol Figure 1 elone cen leed a pereon lo conclude thet Sen Frencisco hes the more equable climeta.

An equeble climeta, however, is one where tempereture changes ere small, navar lerge. To eveluete the difference In the raapect, the successive changes in the 87,600 hours were obtained and the percentage of each different size hour-to-hour change computed. Figure 2 shows the results. In marked contreet with the differences shown in Figure 1. those in Figure 2 era beraly perceptible. Exemination of the computer printouts shows that during this particular 10-year parlod changes of more than 6° F (3 1/3° C) per hour were vary infrequent but were slightly more common in Sen Frencisco then in Minneepolla. Daspite the great difference in the yeerly petterns of temperatures, these two cities evidently have almost equally equeble climates.

It eeems likely thei a comperison of date from other eletions will lead to the seme conclusion. A previous study, based on a much smeller body of dale, showed that the cllmates ei stetlons varying in latitude from 24°N to 48°N were nearly aqueble. Aside from the regular diurnet effects, iempereiure changes come trom the larga-scele atmoepheric turbulence, which trevels everywhere, meking difficultias for the weather torecasters.

Il weathor is indoed o mojor consideration in picking n new location for work or rotirement, one musi go boyond listening to claims of 'equabla weather.' Records of tempereturas, precipitation, humidity, hours of surishino, and air quality ere available from the National Records Conter, Bellsville, Meryland, It is well to koep in mind, moreover, that cost of tiving and sociological considerations (more changeable than the weather?) are likely to turn out to be most important.



Chestey J. Posey is emeritus professor of civil engineering at the University of Connecticut, Stores Structural engineering experience led him into reinforced concrete research and then to association with S. M. Woodward, with whom he authored a lext on hydraulics ot open channel llow. Collaboration with R. W. Powell at the Rocky Mountain Hydraulic Laboratory produced a large-scale study of open channel friction. Together with several other AGU members he assisted T. H. Wiggin In the preparetion of AWWA's 'Spillway Design Practice.' His current research interests are erosion protection and the 'signatures' of rendom time senes.

lowing the initial landslide, thet the principel deatructive

# News

# Satellite Observations of Mt. St. Halans

The mejor eruption of Mt. St. Helens on Msy 18, 1980, was recorded by intrered sensors abound two U.S. Air Force satellites. The extent of the coverege and the completeness of the dete base appaer to be unique, providing information unevsileble from other sources. The eruption wes monitored essentielly continuously, beginning at 15:32:57 UT, less then 1 min after the eerthquake thet eppeere to heve been the triggering event. Dual setellite monitoring permits triangulation, so that both the leteral and verticel development of the ash emission can be determined with good temporal resolution. The date ere being enalyzed at the Spece Sciences Laboratory of The Aeroepece Corporetion. Emphaele up to now has been placed on elucidating the sequence of events during the highly dynemic early eruptive phase, principally the period between inilietion and the lirst GOES photograph el 15:45 UT. The resulting picture differe in meny importent respects from That interred from photographs made by naerby observers. or from indirect evidence such as blesi effacts. The neture and timing of the principal events heve been described in a report to the Society of Photo-oplical Instrumentation Engineers (SPIE) Washington meeting and ere summarized be-

The earliest eruption period was cheracterized by e complex sequence of emissions. At liret only relatively cool meterial (7 < 400 K) wee evolved; part of this material moved toward the eest and northeest et speeds of about 100 m/e. At about 15:33:10, the lirst of at least three seperate emissions of hot meterial, with surface temperatures of 500 K or higher, occurred, None of these ejections, nor the earlier cooler materiel, exceeded en eltitude of 8 km. Thus, elthough e great deal of hot meterial had been emitted, it was confined primerily to the northern tece of the mountein and the southern portion of Spirit Lake prior to about 15:34:50 UT. It was at this time, and not immediately lol-

surge or leierel blest occurrad. A lan-sheped mass of ash (~ 40°-50°) was propelled northward awey from the mountein with en initial velocity of about 450 m/s (i.e., probably ee a shock wave propagating et acoustic velocity in the eir heeted to 500 K by the hot ash). It eppears that the previouely evolved meterial was split by the surge and driven eestwerd end westward at vetocities of 150-250 m/e or graeter. The rapid expension phese lested less then hell a minute end was lollowed by a pariod of lower velocitiae that struction by about 15:37 UT. Coincident with the blesi, the cratar itself stopped emitting algorithment quantities of hol ash for some 6-7 min. Just prior to 15:42 UT, hot ash begen spewing verticelly from the creter, producing the high ash column thei wae to be the dominant feature of the succseding eruption period. Although the collepse of the southern creter well could not be monliored directly, it appeare probable that it occurred primarily during this period between 15:35 and 15:42 UT. The mejorily of the ash was injected into two layers, one at a peak elittude of 18-21 km, moving eactword at about 12 m/e, and the other, lerger mess et 12-t5-km eliltude, where the prevailing eestward wind hed a velocity of about 31 m/a. There were also two discrate plumea which cerried much less materiel but reached considerably higher allitudes. The first of these was produced by the major explosion et ebout 15:35; after rising through the atmosphere et about 40 m/e, it stebilized. by 15:50 UT, et e peak allitude of ebout 24-27 km. The direct ceuse of the eecond high-ellitude pluma is more difficult to determine, since il appeere to have originated juel north of the destruction zone itself and as lete as perheps 15:42 UT. Thie pluma reached a peek altituda of 29-32 km by ebout 16:00 UT; no materiel ejected subsequently reached eo high en eltilluda. The embleni winds between 24 end 32 km were very light, with the result that these plumes evolved internally but did not move repidly awey.

Both plumes and the two principal lower-altituda ash layers can be distinguished in the widsty circulated GOES-West image for t6:15 UT.

Tho new data thus prosent a much more complex picture of the early oruption period than hes been aveilable up to now. First dateils of the analysis are to be published in the Proceedings of the SPIE Technical Symposium East 1981 —C. J. Rice and D. K. Watson, coninbutors &

#### Earth's Core Iron

Geophysicist J. Michael Brown of Taxas A & M University noted recently at the Spring AGU Meeting In Baltimore that the etructura end phase of metallic from at pressures of the earth'e Inner core (approximately 3.3 Mbar) could have graal significance in defining geometrical aspects of the core Itself. Brown worked at the Los Alamos Scientific Leboratory with R. S. McQuean to redetarmino the phase relations of metallic iron in a series of new shock-wava exparimants. They lound the melting point of Iron et conditions equel to those at the boundary of the aerth's outer (liquid) and inner (solid) cores to be 6000° ± 500°C (Geophysical Research Letters, 7, 533-538, 1980).

A significant factor in those rosults is the fact that of the two high-temperature, high-pressure phases of iron, the \( \lambda \) (faco-centered cubic, fcc) or + (haxegonel close-packed, hoof is sighta et the innor-core boundary. Furthermore, at pressures and temperatures of the bountery at the interface belwaen tha mantle and the liquid outer core a question prises as in which prinse of Iron has molled. This lactor is important because the cluseness in temperature to motting ni any point within the liquid outer core could have significant consequences on the geomognetic dynamo.

Brown and McQuoen, while not being able to constrain thair dota sufficiently to noswer the questions unaquivocally, nonethaless have come up with the lightest constraints so ler in thoir gaophysical model of the core. Their shockwave data, after roduction from the Hugoniot and even taking Into account the uncertainties (see Figure 1, shaded regions), indicate that at prassures equivalent to those in the coro, the epsilon-iron (1-Fe) phasa is the best candidata, but II may be too densn. To address the density problem, Brown and McQuoon called upon the popular notion that sullur may be dissolved in the core.

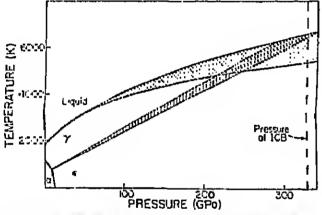


Fig. 1. Phese diagram for metallic iron, besed on shock-wave experiments (a = bcc phase: A = fcc phase; r = hcp phese; shaded ereas represent uncertainties in the dete; ICB = inner core boundaryt. (After J. M. Brown and R. B. McQueen, The squation of state for iron end the earth's core. In High-Pressure Research in Geophysics, edited by S. Aklmoto and M. Menghneni, In press, APJ, Tokyo, 1981.1

In edding what Brown dascribed ee 'component X' (meening the eddition of sulfur to the Iron core), complextties such as the ideelity of thermodynamic mixing, the bounds of en adiebatic geotherm, and tha consequences of liquid thermal convection wera considered. Il eullur is dissolved in the iron-rich liquid of the outer cors, its concantralion must be on the order of 10% by weight, or less, according to the calculations. Probleme in the calculations ere ratated not only to the phase of iron but to eulectic melting phanomena that must be aveluated if sulfur is present.

As pointed out by Brown, even with the naw date, much remains to be underslood about the bahavior of majarlels undar the extrema conditions of the earth's cora, before tha validity of the proposed models can be essassed quantitelively. Most existing theories on maiting, conven mixing were formulated for simplo, pure systems at much lower pressures and lamparatures. Even so, these now resulle constitute the 'stale of the ort' in our knowledge of the coro. Brown proposed the tempareture of the core-mentle boundary to be approximately 3700 °C for en outer-core liquid composed of iron plus 5%-9% by woight autlur. This lemparature la considerably higher than pravious estimeles. resulting in necessary reconstruction of the thermal models of the lower mantle. Brown suggests the oxietence of a 200-km thick 'thermat boundary layer' in the lower mentle. or

### **Gulf of Maxico Model Confirmed**

A model of the origin end evolution of the Guli of Maxico hes been substantially confirmed by core eamplas teken from the Guil floor by tha Glomar Chellenger, eccording to Richard T. Builler of the University of Texas at Auslin and Wolfgang Schlagar of the University of Miemi, co chief scientisis of the research vassel's leg 77.

Anelysis of samples takan from eix sites in the southeaetarn eraa of the Gulf showe that the Gulf of Mexico originated in much the same way and elmost elmultaneously with the North Atlantic Ocean. Until recently, the Gulf'e origin did not fit the commonly accepted model of oceen evolution. explained Builler.

The modsl postulates that the North Allentic and the Gulf ol Maxico begen to nil spert about 180 to 200 million yeers sgo when the continents as we know them lodsy formed the supercontinent Pangsa. Then, when Pengse broks spari, about 150 to 180 million yssrs sgo, the ocean basins of the North Atlantic and the Gull of Mexico bagen to form. Rifts also appaered on the seefloor, spewing mollan melerisl which than spread out, hardened, and formed new ocssnic crust. Attar thei, eccording to the model, the two basins went thair saperate ways. The seelloor continued to spread out in the Allsniic, Buffler said, but cessed in the Guff. The Gulf of Mexico crust continued to subside as it

Cores recovered by the Glomar drilling include meterial from the old rifled continentel cruat at two locations, ec-

cording to Buffler. The Glomar's drilling on this isg lurned up other unexpacted finds. Cores of rock daposits found at the bese of sleep carbonete reels revealed interbedded leyers of oxyganaled and anoxic limasionas that resemble the oll-beering termations in Mexico. Older carbonala reel metarial tound on uplifted cruelat blocks indicates theil periods of shallow-water conditions existed in that part of the Gulf before it sank, the University of Texas scientist said.

Deep-water timestones near the reel are e potentially rich source of petroleum. Analyses show thei tha beds have not been buried deep enough or healed sufficiently to have ganeraled oll, however. Oil stains eround asphallfilled Iraciurss in the rock, though, suggast more mature petroleum source beds could be found et greater depths.

Builler aald. Additional drilling and geophysical studies, including salsmic reflection and refrection work, will be needed to subslantleta the Gulf of Mexico model further, Buffler Iold Eos.—BTR 🕸

### **GAO: Water Monitoring Needs Improvement**

Bellar monitoring lechniquas are needed to assess the quality of rivers and streams, according to a recent report to Congress by the General Accounting Office (GAO). Weter samplas are taken too infraquently, GAO says, and stalions are placed too far apart 'to deal with the complex nelure of water quality.

'Accurate, reliable data on the ectual condition of the netion'e rivers end streams are necessary for sound anvironmental planning and management, writes Millon J. Socoiar, scting comptroller general of the United States, in the cover lefter that accompanies the report. 'Existing national weler-quality monitoring networks operated by the Environmenial Profection Agency [EPA] and the U.S. Geological Survey [USGS] ... do not provide the type or quality of data naaded."

The existing EPA and USGS water-quality monitors are three lixad-station, fixed-interval sampling networks. These networks routinely and periodically sample the water st fixed locations. But, according to GAO, they lack the ability to racord changes in water quelify throughout a dreinage basin and to record tha delly fluctuations of water chemisfry, including the amount of dissolved oxygen.

GAO recommands that the network progrem be rapleced by epeciel studias which address specific situations. 'In contrest to the routine approach used in fixed-station monitoring, specief studies are lellored to spacilic hydrologic and water-quality conditions, the report stefas 'Because spacial studiae concentrele on perticular problems, they vary widely in sampling frequency, number of locations, and water quality leafs. Howaver, they ganerelly involve more intansive sampling of the effected river segments than is done through fixed-station natworks."

Not surprietingly, the USGS and EPA disagree with GAO's recommandelions. They maintain that the networks should be continued for netional parspective on wefar quellly end other uses.

Last year, in ils comments to the draft of the GAO report, EPA said that most weaknesses of fixed-elation monitoring that GAO Idantitied 'era elao problams with intensiva eurveys. Therefore, EPA conlinued, adopting the recommendation to disconlinue lixed stallors and emphasiza intensive eurveys will not in itself solve tha problems of propar siting, Ilming, end quellly eesurence, and mey in feci increese these problams."

The USGS elso took issue with the document's dreff. The Survey was quick to point out the two approaches to water-quality investigation ere different: 'The objectives of fixed-station monitoring locus prin end charecterizellon of wefer quality in apece and tima.' A coordinated series of epaciel eludies would not fill these objectives with e nettonal geogrephic scope, the Survey edd-

Alfer reviewing the lengthy comments to its draft report, GAO concludes in its final report to Congress that if elende by its original recommandations.—BTR &

### Space Telescope Shaped and Polished

Shaping end pollshing of the 94-inch-diemeter (2.4-m) primery mirror for the Spece Telsscope has been completed at the Danbury, Connecticul, lacility of the Perkin-Elmer Corp. The mirror eurlece hee baen completed to e perfection that deviates, at any point on the euriece, less then one-millionth of en inch from en ideally pertect surfece. The primary mirror le the m an opticel component of the Optical Telescope Assembly (OTA), a major efament of the Space

Earth orbif by the epace shuttle in early 1986 and will have lering haze of Eerth's etmosphere, if will enable an investi-

# Forum

### Handin Replies to Russell

Your editorial in Eos. March 10th, on the functions of the Committee on Education end Human Resources poses several provocative questions but overlooks whal I regard as the most critical issue of all. While the Union's siforts to ettract more women end minorities into geophysics are commendable, fest becoming more generally serious is the quesilon: how do we recruit any students into our graduals schools end then retain them through the doctorale.

The inselleble demand by industry for eludents at the pachelor'a end mester'e levels in geophysics (and geology and petroleum enginaering) has forced alerting saleries so high thet fewer and fewer students ere willing to stay on to oraduala work at affordable stipende for fellowships and asalstantehips. My expartenca at Texes A&M University may not be typical and may therefore prompt undue exaggers lion, but it is certainly not reaseuring for the luture of higher educellon.

The combined annolimante of some 600 in our departments of geology and of geophysics era probably among tha nation's lergaet. OI thace about 150 ere greduale sludents, but only about 25 ere doctorel candidates, and many of them are foraignare who will not be precticing in this country. Worse still, few of our Ph.D.'s bacome teachers in American universitias becausa dedication alone does not elwaye compensate for tha \$5000 to \$10,000 more that can be earned in industrial reeserch and the national leboratorias. Serving ee e frade school for industry is one legitimele function of e land-grant institution, but training for careers in higher education is surely another. Nor does the brain drain elop with the students. Recruiting and reisining young feculty have become discouragingly difficult.

So, in my judgmant, for many of the flaids of earth science tha key quastion le simply Ihls: who will teach the next ganaretion of eludente our country will desperalsly need as problems with energy end mineral resources and preservation of a healthy environment become ever hard-

I beliava that industry le bacoming awere that its sources ol edequately treined manpower will vanish—and irighteningly soon—if this wholesala desertion from the academy does not cease. Your commiftee might wish to addrass this lesue. Industry can help in its own bast interests, end discussions with its concerned representatives would be time-

Alool like most professors, I have navar been an elarmisi, but now I honestly believe that the decline of graduate education is too serious to ignore.

> John Handa Associate Dell College of Geosciences Texes A&M University

telascope will be able to see stars end galexies which ere es much as 50 timas faintar then cen now be observed from Eerth-basad teleecopee

To take full advantage of this undistorted view of space, the talescope optice hed to be polished to a much higher accurecy then those used in Eerthbound telascopes. Space Teleecope's primary mirror was pollehad to specifications finer then for any previous lalescopa mirror its alze.

The Spece Telascope is of en opticel design known as Rifchey-Chrallen, e loldad syelam with a secondary mirror in front of the primery mirror end the image plane behind the primery mirror.

Menufecture of the primary mirror blank bagan of Corning Glaes Works, Coming, N.Y., In October 1977. The malerial usad for the blank le a Corning product celted Ulira Low Expension glass, which hee extremely low thermal 69 pension properties. The main mirror assambly consists of 6 Iron plate about 1 Inch thick, with e honaycomb Interior aepereting it from the back plate, also about one inch inch.

Tha front and beck pletee and honaycomb interior sirucfure ara deelgned to eliminata eny etructural chenge in the mirror caused by alther thermel or gravity stresses. While in operation, the front pleta of the mirror will axist et near spece temperefuras, while the back plate operates at near relura of 21° C

The blank was dalivered to Perkin-Elmer from the Corning plent in Decamber 1978. Opticel fabrication begen with rough grinding of the front and back eurlaces and of the Inelda end outside edgee of the mirror ehepe. This was lollowed by fina polishing of the mirror front eurlace, using a specially devaloped computar-controlled polisher and exlensiva date reduction computer eoftwara, which began in Auguat 1980,

In the next elaga of febricetion the primary mirror will have two exfremely thin, yet uniform, coefings explied to its pollehed surface. First, e reflective layer of pure aluminum 850 Å fhick will be epplied end then e profective layer of magneelum fluoride 275 Å lhick, which will prevent oxide: flon of the aluminum.

Tha coaling operation will take piece in e apecially deeigned eil etainlees-efeel vecuum chember, it le the largest chamber of lie kind in the world end operates at a vacuum very naar that of space.

The requirementa for the mirror call for it to be reflect from the extreme ulfreviolat (1216 A—tha Lyman alpha line for hydrogan) to the extreme infrered (1000 µ). The miro epedifications call for at least 85% raflactivity of the neon

red reconance line of 6328 A. Affar coafing, the mirror will be installed in the Optical Teleacope Project and eligned to the sacondary mirror, to:
cal plane, scientific instruments, and fine guidence setions. [Source: NASA] 2

# He/Ar Ratio: Earthquake Harbinger

Hallum and argon, squeezed out of the earth through itssures by deep internel pressures, mey signal an imminent earlingusks. There has been little evidence, however, directly linking stress with ges emissions. Ryulchi Sugiseki ol the serth sciences depertment at Nagoye University in Japan raports in the June 12 Science that the vertellons of he Hs/Ar relio of ges bubbles in e mineral spring coincide with underground stresses coused by the earth tide.

'A comparison of the varietion of sirein in the ground resulling from the eerth tide with the observed fluctuation of tha rallo shows e good correletion, Sugiseki wrots. In eddition, he says that the ratio fluctuellon is more closely lied to hatidal strein then to elmospheric pressure or tempera-

Sugisaki bases hie report on measurements of the Ha/Ar ratio of gas bubbles in the mineral water et Byakko Spa in Mizunami, located elong the active Byobu-Sen Feult.

The strein from the eerth tide is 100 times less forceful than 'ultimate cruetal strain,' which cen ceuse earthquakes, he says. Suglsekl concludee that the He/Ar retio can ba used as a strain gauga for the cruel: 'Continuoue observation of gas quelity et a locetion geochamicelly sensitive to stress at depth could therefore be meaningful for earthquake prediction.'—BTR 🕉

### Mora Fulbright Opportunitias

Six Fulbright ewerds ere evellable for research, in any field to be performed in Africe for 3 to 9 months between September 1982 end September 1983. Also aveilable ere 2) awards for research in Indie, in any field, for which that grant duration is 2 to 10 months during the 1982-83 academic yeer. Application daedlina for all ewards is Auguel 1

An announcement booklet, 'Fulbright Lacturing and Research Abroad, 1982-83, Includee terms of award, requirements, and selection criteria. To receive the brochure, write to the Council for International Exchange of Scholars, 11 Dupont Circle, N.W., Dept. N, Washington, D.C. 20036. 5

#### Geophysical Events

This is a summery of SEAN Bulletin, 6(5), May 31, 1981, a publication of the Smithsonian Institution. The complete butterin is availat's in the microtiche edition of Eos, es e microfiche supplement. @ a paper reprint. For the microtichs, order document number EBI-003 at \$1,00 from AGU, 2000 Flonde Avenue, N.W., Washngton, D.C. 20009. For reprints order Sean Bulletin (give detes and volume number) through AGU Separates: \$3.50 for the first cop for those who do not have a deposit account; \$2 for those who do, additional copies are \$1.00. Orders must be prepaid.

Veranic Events (All times are local)

Pegan (Meriena Is.): Strong activity ends; USGS observalions summarized.

Alald (Kurlla Is.): April-May eruption datailed. Mt. St. Helens (Washington): Lava extrusion edds to preexisting dome.

Kilausa (Hawell): First Intrusion Into the southwest rilt in more than 6 years.

Sameru (Indonasie): Mudflow kills more than 250. Prion de le Fournalaa (Réunion Is.): Eerthquake swarm, 1981 flowe mapped.

#### Krsfle (Icsisnd): Slow Inflation continues; SO2 messured. Arenel (Coste Rics): Lave extrusion continues.

Poás (Costs Rica): Incsndsscencs observed. Lengils (New Britsin): Wesk eah smission. Manem (Blamsrck Sas): Ash sjaction end glow. Assma (Jspsn): Incressed setsmicity but no eruption. Sskurazims (Jspen): Explosions; esh sjedion; B-type aarthauekea.

Atmospheric Effects: Volcanic material in stratosphere over Virginia, Wyoming, and Coloredo; source uncartein.

Pagen Voicano, Meriana leiands, Weslem Pacific Ocean (18.13°N, 145.80°E). A major sruption of North Pagen sierted Mey 15 (see Mey 28 Eos), preceded by earthquekes first fell in late Merch or early April. On May 15, the first of e eeriee of closely spaced aarthquakes (at least 13 lell) began al 0745 (1745 GMT). Al 0915, residents heard a loud boom, followed immediately by the baginning of the eruption, which apparently reeched full Intenelty almost immediately. Three venie, oriented about N-S, were eclive. Airline end rescue pilois reported that the height of the erupilon cloud excaeded 13 km, and Japen-based weathar rader reported ash to heights of 18-20 km. Lava flowe were noted by residents very soon altar the appearance of the ash-scoria column, and geologic observations show thel ash eruption end lave emission look place simultanaously during moet of the eruption. At 1930 there was a nolebla decreese in plume height and density. The U.S. Nevy reported a brief period of vigorous ash sjection around noon the next day, and incandescent activity was seen May 19 from Alemangan Island, 35 km awoy.

A USGS teem of Norman Banks, Robert Koyanagi, and Kenneth Honma observed only interinttent eruptive activity during their May 20-28 stay on the Island. Increases in tho level of hermonic fremor and the number of discrete higherfrequency events preceded three episodes of extrusion of small ea leve llows and one period of ash emission. Alter Mey 26, only minor luming was observed.

The volume of eruptive products ejected through May 28 axceeded 50 to 106 m<sup>3</sup>, and a large part of the arabte land was covered by lava llows and alrial ash and scoria. Lava llows wera predominantly aa, ranged from 3 to 30 m in thickness and traveled as much as 3.5 km from the vents. The northernmost vent (about 1 km north of the summit) built a tephra cone about 80 m high that covered an area of 0.90 km<sup>2</sup>. Ash and scoria deposits exceeded 2 m in thickness northwest of the summit crater. Lithic blocks and juvenile bombs as large as 1 m in diameter were thrown inore than 2 km from the summit onto the north tlank of the volcano. Base surges, evidenced by low-amplituda (4-20 cm) duns and antidune leatures and preferential upslope tree damage, flowed down restricted corridors to elevations of 200 m on the north and south slopes. Devastaling phenomens, such as widaspread pyroclastic llows, did not take place. The events of May 15 caused no injuries to the residents, but some fivestock were killed outright, and others wers starving because of the extensive destruction of vege-

The level of a west llank lake dropped regularly at a rate of ebout 24 mm/day during the 8-day USGS visit. The highast of four stations of an electronic distance-measuring array Installed on the south flank moved steadily southward. 68 mm in 6 days. Little movement was noted from the slations lower on the tienk. Seismic monitoring May 20-28 showed conlinuous harmonic tremor and shorl bursts of high-frequency signels, indiceting intermittent extrusive evenle such as degessing and low-lavel lava lountaining.

However, no significent eerthquake activity was delected. Electron microproba enalysis of one fused sample of elffall scoria (by John Sinjon, University of Hawail) Indicated that it was more or less typical of basaits from the northern Marie nas

Information contacts: Norman Benks, Robert Koyenagi, end Kennelh Honma, Hewalien Volcono Observatory, USGS, Hawell Volcances National Pork, Hewali 96718

Semeru Volcano, Java, Indonesia (8.11°S, 112.92°E). Thirty centimeters of rain in 2 hours on Mey 14 dislodged pyroclestic daposits from the upper tlanks of Semeru. Approximately 5-8 million m3 of breccle, volcanic sands, esh, surficial cover, and vegetation slid down the 40°-60° eestern lienk into the vallays of the Tunggeng end Set rivars. The mudflow killed 252 persons, laft 152 injurad end 120 missing, and flooded 826 hectaree of rice fialds and 16 vitleges along the rivers' banks. It erodad old tahar deposits and washed ewey a dike built in 1912 aftar a simitar evant had dastroyed the city of Lumajang (40 km aast of tha volcano) in 1909.

In Jenuery, the Volcenological Survey of Indonesia had wamed local euthorities in regiona south and southeast of Sameru of the dangar of mudilowe because of the onset of the monsoon end the presence of fresh nuéa ardenta dajustis on the upper south flank (soa April 7 Eos). Although a thar also moved down the south flank on Mey 14, no caeualtiee wera raported there.

Activity at Semeru was normal during May, with obout 80 gas oruptions each day. The lavn dome continuad to grow al nboul 100 m<sup>3</sup> a day

Information contact: A. Sudradjet, Director, and L. Pardvanto, Sontor Vnicanologist, Vnicanntogical Survey of Indonosia, Diponogoro 57, Bandung, Indonnsia.

#### Earthquakes

Depth Time Magni-Date GMT tudes Latitudos Longitudes Focus Region May 2 1605 6.3mb 36.42 N 71 16 E 225 km NE Al-May 25 0525 7 5M<sub>S</sub> 48.82 S 164 90 E 10 km Tasman SW of Zealand

The May 2 earthquake was widely left. It was centered in The Alghanistan-Pakistan-USSR border region, about 275 km NNE of Kabul. The May 25 shock occurred in the ocean on the western slope of the New Zealand Plateau. about 350 km SW of South Island, New Zealand, No casualtias or damage were reported for either event.

Information contacts. National Earthquake Information Service, USGS, Stop 967, Denver Federal Center, Box 25046, Denver, Colorado 80225. Geological Survey of Pakistan, Quetla. Pakislan

Meleorilic Events

Fireballs: Atlantic Oceen, Austrie, Brazil, Czschoslovakia (2), England, Mediterranean Saa, Syrie.

• Entire report printed Excerpts of report printed

# **New Publications**

Numerical Methods in Geomechanics,

Wilke (Ed.), Belkama, Rolterdam, The Nelherlends, vi

Reviswed by E. G. Bombolakie

<sup>‡</sup> 296 pp., 1980.

This volume is the fourth of lour volumee that developed iom the Third intameflonel Conference on Numerical withods in Geomechenice, held in Aachen, Germany. The publisher of theae volumee advartiees lisell es a email internationally orianted firm that offere special services for Publication of conference proceedings. Three of these eary-083 are especially worth noting to fecilitate understanding of the proe and cone of the volume under consideration. The Ihree services are (1) production from cemere-reedy copy within 8 weeke, (2) no cherge for the production, and (3) specimen pagee, typing ineirucilone, and paper supplied to each suthor. Each euthor accordingly preperes or supervises vises preparetion of his own 'gelley proofe.'

his resulting epaed of publication is impressiva, Deepite the lact that the conference was held in April 1979, four volumes of 130 papers in herdcover olothbound form were Systlable to the public in 1980. The spead of publication is somirable and dealreble in view of the long delay frequently Involved in the publicetion of many conference proceedings, provided of course that there is propar peer review and adequate editoriel control. This proviso appears to be a undamental problem here.

This book review is concerned only with volume 4. There is no evidence in this volume that the papers were subjected in ed to proper externel pear review. In fact, there ere four thes of circumstantial evidence that there was liftle or no Peer review and inedaquate aditoriel control of the 22 pe pers in this volume. First, there is one paper in which there are no ligures. If reada like a peper presented at a meeting by a speaker who forgol to bring projection sildes thet would illustrate the telk. Second, there was only one dis-

cussion of one paper. The discussion was critical of that paper in more then one important respect, but no reply to the discussion was published. Third, the English language in a number of papers by loreign authors is written in quaint end confusing stylas. Fourth, there is no indication of axiemel peer review in eny of the ecknowledgements that are recorded in the papars. For exemple, e lew authors ecknowledgad helpful commente, but only from colleaguas at Ihair own institutions.

On the basis of e reeding of each peper, it is sporopriate here to paraphrase one of Jamee Gilluly'e judgements in a book review he wrote for EOS (published in 6, 22, May 29, 1979). Nemely, es is the case with most product is a mixed bag: some good papers, e considerable number of repetitive papers, and a notable bunch of expensive waele paper. The papere in volume 4 deal with seven main topics: theoretical developments, llow and consolidetion, conatifulive laws, rock behevior, embenkments end slopes, dynemics, and soil-structure-interaction with respect to loundations. Several important concepts of soil mechanics (e.g., the concept of residuel sirength) occasionelly are epplied to rock mechanics problems, evan though presentday documentation le not sufficient to justify the validity of Ihis procedure. Many of the papere employ linite elament techniques in enalyses of nonlinear eoil end rock mechanics problems. The interested reader who is not femilier with finite element analysis cen find a good concise explanation with worked-out examples in Richard Goodman's book, Methods of Geological Engineering, published by Weel Publishing in 1978. One of the most cruciel factors in the entire analysis is the way in which constitutive laws ere lormulated end used in the enalysis. If is this lector that providee one due for recognition of some of the beffer pepers.

The leck of proper externel peer review and editorial control makes fine publication of conference proceedings unfair to the reeder, to the eufhors of the beffer papers, end to the profession involved. This situation also makes it difficult for a reviewer to be lair in crediling what seems to be ell of fhe beffar papera. Only e lew cen be mentioned hera, par-

ticularly those of potential interest to AGU members, For axample, the paper 'Nonlinear affects in dynamic soll structure interaction, by J. M. Roesset and H. Sceletti, makes an eveluation of such effects for nucleer power plant typa elructures, with particular emphasia on the relative importance of partial separation end sliding of the foundation. The paper, 'Development of an analysis for cyclic axial loading of pilas, by H. G. Poulos, ie of particular interest for two reasons. First, if is ralavant to pile foundation problems for offshore platforms. Sacond, even though the enalysis is based on elastic theory. If makes allowance for pile-eoil slip and soil nonhomoganaity in terms of some refliar beeic principles. Finally, the peper 'Siress-strain theory for normaily consolidated clay, by P. V. Lada, will be an important confribution if his essertion proves to be correct. The assarfion is that he has abown how 10 material paremoters can be used to calculate strains in the Grundite Clay for eny combination of effective stressas during primery loading, unloeding, and reloading. Incidentally, no abstracte ara incorporated in any of the papers in this voluma.

E. G. Bombolakis is with the Department of Geology and Geophysics, Boston College, Chestnul Hill, Messachusells.

### New Listings

Items tisted in New Publications can be ordered directly from the publisher; they ere not available through AGU.

Acid Precipitetion-Effects on Forest and Fish, Flust Report of the SNSF Project 1972-1980, L. N. Ovarrein, H. M. Selp, and A. Tollan (Eds.), Reciemo, Oalo, Norway, 175 pp., 1980, Availebla free of charga,

Advances in Food-Producing Systems for Arid end Semiar-Id Lends, Perts A + B, J. T. Manessah and E. J. Briekay (Eds.), Academic, Naw York, xvi + 1274 pp., 1981, \$110,00.

Advances in Space Research. Plenetary Interiors, H. Stillar

The 12-ton unmanned telascope will be placed in circular en initiel allitude of 600 km, pulling it well above the intergator to collect data seven timee farther into space then now possible—as much as 14 billion light-years—and to chaerve some 350 limes more volume of visible space. The and R. Z. Sagdeev (Eds.), Pergamon, New York, v 🕡 265 pp., 1981.

A Guide to Classilication in Geology. J. W. Murray, John Wifey, New York, 112 pp., 1981, \$19.95.

Applied Geophysics for Geologists and Engineers: The Elements of Goophysical Prospecting, 2nd Ed., D. H. Grifliths and R. F. King, Pergemon, New York, xif / 230 pp., 1981, \$14,50.

Astronomy and Astrophysics Abstracts, vol. 28, S. Böhme. W. Flicke, I. Helnrich, W. Holmann, D. Krahn, D. Rosa, L. D. Schmedet, end G. Zech (Eds.), Springer-Verlag. New York, x + 841 pp., t981, \$56.20 cloth.

Cese-Studies in Groundweter Resources Evaluation, J. W. Lloyd (Ed.), Clarendon, Oxford, 206 pp., 1981, \$74.00. Cosmic Plasma, H. Allvén, D. Reldel, Hinghem, Mass., xi + 184 pp., 1981, \$39.50.

Developments in Geophysical Exploration Methods —2. A. A. Filch (Ed.). Applied Science Publishers Ltd., London, ix + 234 pp., 1981, \$36.00.

Economic Geology and Geolectonics, D. H. Teriling, John Wiley, New York, x + 213 pp., 1981, \$54.95.

Energy et the Suriace of the Earth: An introduction to the Energetics of Ecosystems, D. H. Miller, Acedemic, New York, xvII + 518 pp., 1981, \$49.50.

Evolutionary Biology of the New World Monkeys and Confinentel Drift, R. L. Clochon and A. B. Chisrellt (Eds.), Plenum, New York, xvi + 528 pp., 1980, \$49.50.

Exploration of the Poler Upper Atmosphere, J. A. Holtet and C. S. Deehr (Ede.), D. Reidel, Hingham, Mess., xvi + 498 pp., 1980, \$58.00.

Geographic Names of the Aniarctic, F. G. Alberts (Ed.), Ns-Ilonel Science Foundellon, Washington, D.C., xxii + 959 pp., 1980, Aveileble from Supstintendent of Documents. GPO. Weshington, D.C.

Geology of the Continental Margins, G. Bolllot (translated by A. Scerth), Longmen, Inc., New York, xl + 115 pp., 1981. £4.95.

Geothermel Systems: Principles and Case Histories, L. Rybach and L. J. Muffler (Eds.), John Wiley, New York, xlv + 359 pp., 1981, \$61.95.

Geothermie: Eine Einführung in die Aligameine und Angewandte Wärmelehre des Erdkörpers, G. Bunleberth, Springer-Verleg, New York, lx + 156 pp., 1980, \$14.20. Highlights of the Jepanese IMS Progrem, Institute of Spece end Asronaulicsi Science, Tokyo, Jepsn, xli + 445 pp.,

Methemetical Modeling of Hydrologic Series (translated from the Rueslen by T. Guerchon, edited by D. Perclous; original previously reviewed in Eos. 59(5), 465-466 1978), G. G. Svenidze, Waler Resources Publications Fl. Collins, Colo., x + 314 pp., 1980, \$25.00 (subject to change without notice).

Monsoon Dynemics, J. Lighthill end R. P. Pesrce (Eds.). Cembridge University Press, Naw York, xxli + 735 pg. 1981, \$130,00.

Polable Waler From Wesleweter, M. T. Gittiss (Ed.I. Noyes Dete Corporetion, Perk Ridge, New Jarsey, xil + 305 pp., 1981, \$42.00 (cloth).

Proceedings of the internetional Committee on Geodynamics, Group 6 Maeting et Peshewer, November 23-29 1979, R. A. K. Tahirkhell, M. O. Jan, M. Mejid (Eds.), No. tionel Centre of Excetience in Geology, Peshewar, Patisten, 213 pp., 1980, 65 French frencs (herdback), 55 French frencs (paperbeck). Aveileble from P. Le Ferl. C.R.P.G., B.P. 20, 54501 Vendoeuvre-les-Nancy Cedex Frence.

Reference Coordinets Systems for Earth Dynamics, E.M. Gaposchkin end B. Koleczek (Eds.), D. Reidel, Hingham Mess., xtv + 396 pp., 1981, \$49.95.

Raffaction Seismology: A Tool for Energy Resource Exploretion, 2nd ed., K. H. Weters, John Wilsy, New York, xi + 453 pp., 1981, \$44.95.

Head, Deportment of Ocsenography & Geess Snginearing. The Floride Institute of Technology seeks an Individual to head a multidla ophiary department of scientists and angineers. Position to commence as a sarry as September 1981. Candidates must possess a Ph.O. degree and have demonstrated mentioniaus scientific work hereacoustanty or ocean andinearing with interest. in ceanography or cosan anginearing with interest and experience in teaching, research, and adminisand experience in teaching, research, and edmina-traion. The Department has graduels and under-graduets interdisciplinary programs in biological, demical, geological and physical oceanography, and ocean angineering. Curricule for the Ph.O. are and ocean anginerating available in physical, chamical, and biological cosmography. The department to part of, a fact retriguely arising in a community on the seet coset bridge with technical includings. Canalitis include the bitter for lamily mambers. Sensitis for the community of the communit nes quon for larmly mambers, dend resume and names of relarences to: Chairman of Search Committee, Department of Dosenography & Ocean Engineering, Florida Institute of Technology, Malbourne, FL 32801.

Fiorida Institute at Tachnology la en equel oppor-

Poist Ceaanegrephor/Sas Ice Dynomicist. points to evellable under the Intergovernmental Personnel Act of 1970 for persons now employed n Sale local government or in collegea and univer sea. This position is located within the Oceanic Processe Brench of the Environmental Observato Division of the Office of Space and Terrestria Applications, NASA Headquerters. The position is force year, with the possibility for ranewal far an actional year, Pay will be at a tevel commensurate with experience, and will be astabilished after a

Candideles must have been employed by the unventry in a permanent position for at teast 90 days or be a career amployee of a Steta or leca mment, Candidates must also maet the Fadera quelification standards for the position. These at a follows: a degree in an appropriate field of

Tenth Presentation of the

Walter H. Bucher Medal

Jack Oliver

la eriginal contributions to the basic knowledge of the earth's crust

Walter Bucher was a true student of the earth. He began

as a zoologist, turned to peleontology in graduate school,

and bacama interested in structurel geology through stud-

is of deformed fosetts in the Alps. His book, Deformetion

of the Earth's Crust, tirst published in the 1930's, was a he-

toic ettempt to find order in the etructure of the globe. He

Jack Oliver was e student of Walter Bucher et Columbia,

and perhaps some of Welter's versetility rubbad off on him.

ack begen his geophysical career in the atmosphere, tried

his oceans but tound them too unstable, and tested the

Arctic ice before settling on the solid aerth. Although he is

dalmed by the selsmologista es one of their own, he has

Jack was siso e student of Meurice Ewing and invented

two-dimensional model selemology [in response] to e ques-

ion on one of Ewing's gaophysics axeminstions that those

in the class snewered unimeginatively. The pepar describ-

ing the techniques was eafacted as a classical paper by the

located of Exploretion Gaophysicists. His Ph.D. thasie was

on the use of surface weves to determine the structure of

wave propagation to study the crustel structure of the Arctic with t

With Prese and Ewing he epplied normal mode theory

to the determination of crustel structure in many parts of

he world. He pioneared in the study of higher modes of

rocks and their aedimentery cover.

hat further strengthan the model

surface waves and thair epplication to study of the crustel

Jack recognized in the early 1960's the importance of

sludying deep-focus eerinquskes and the phenomene as-ociated with tham. So he esteblished e salemogreph net-

work where they are most frequent—in the Tonga-Fill re-gion. Data from this network led to definition of the subduc-

ton procese, s vital link in the chain of ideas that make up

our currently accepted model of pleta tectonics. He and hie

sudents heve continued to contribute new date and ideas

Mois recently Jeck turned his attention to the continents.

The successes of the lest querier century in defining the

Mean crust and mantle were not merched by equel [ad.

hs Pscilic region, and ebout the eems time he used Lg

always mainleined e atrong interest in the crustal rocks end

ructure in addition to his interest in their electic prop

has a long essocietion with the American Geophysical

Inlon end was its president from 1950-1953.

AGU

AGU Awards

acience, plus three years of progressively respansi-ble expartence in dutias related to the position. This individual will be responsible for planning. developing, and implementing a acientific rese program in setallite ramota sensing of oceanic pro-cesses in polar regions. A background in polar oceanography, see ice dynamics, or a closaly-relat-ed text is required; experience in remote sensing, elthough ctstrable, is not essantial. A Ph.O. ar equivelent training end experience la mandatory. Interested parties ahould send a current reauma

to NASA Headquarters. Alin: Mrs. Catharine Zegowitz, Coda EPM-3, Washington, O.C. 20548. Selection for the position will be made from otharwies aligible candidates without discrimination for any normerit reason such as race, colar, religion, sex, national origin, politics, marital slatus, physical handicap, age, mambarehip or normembership in en amployes organization, ar personal favoritism.

Elactron Microprobe Tachnical Spaciolist/ University of Colorado. The department of Geological Science, University of Caloreda, Saulr, seeka a parson who will assuma rasponalbilit for the department's electron microprobe labora-tory. Outles will include day-to-day aperelion of our MAC 400 microproba equipped with a KEVEX EOS system, instruction of new operators, maintenance of the microproba as well as other X-ray equipment of the microproba as well as other X-ray equipment within the Capariment, microproba software and hardware developmant, and participation in re-aaarch projects involving silicate, sulfida and oxide mineralogy. The job requires either a dagree in electronic ar elactrical angineering, or two years of fachnical experience utilizing electronic instrumentation associated with an electron column tretrumant. An Individual with an M.S. degree in Geology and microprobe axpariance will be considered highly destrable. Salary ranges from \$20,000-\$25,000 depending on experience. Please eard, by August 15, letter of application and resume to acuse the construction of the constructi gar, Personnal Oaparlmant, University of Colorada, 1St1 University Avenue, Soulder, CO 80309.

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Physical Gossnographer. A postdoctoral ro-search pasitian in physical oceanography is oval-able at the University of North Carolina et Chapel Hill, ta begin as aerly as August 1981. Ph.O.'s with Stream dynamics, gasphysical fluid dynamics, or aceen acoustics are oncouraged to apply. Initial appointment will be for ane year with a possible continuation through a maximum of three years
Please aand vitae and the names of three reterances to Professor Jahn M. Bana, Marina Sciences
Program, 12-S Venable Hall O4SA, University of North Ceroline, Chapat Hill, North Caroline 27St 4. The University of North Careline is an affirm abve

Land Stability Scientist, Ackautars Psimaraten North, Naw Zsaland. Scienlist or anginaer to lead a group of five scientials and two technicians at the Water and Sail Olyston, Ministry af Warks and Oevelopment, Askeutare Sciance Centre at Pelmaratan North, Naw Zaatend in stud-les af land Instability. Tachnicel support ovariable from four other groups on campus—plant materials for erosion control, land resource survaye, catch mant condition auryeys trampts sansing), and hydrology. The study of the role of plants in stabili grazed hill country is a cantral concern it is hope that the land stability group will improve under-standings of basic mechanisms of slope instability-particularly soll plant water inter-relationships Qualifications sought are Ph.O. or goad honaurs

degree in soil physics or soil mechanics, backed by experience in land instability research or ereas related to it.

Applications giving details of qualifications and experience to be sent to The First Socrolary (Administration) New Zestand Embassy

37 Obsarvatory Circle, N.W. Weshington, D.C. 20008 lor lorwarding to Minietry of Worke and Develop-mant, P.O. Box 12-041, Wellington North, New

Research Peeltion/Spees Plesma Phystes. Applications are invited for two possible re-assich positions in the Department of Space Phys-

tes and Astronomy, Rico University One position involves work on a computer code for aimulating the lorge-scale dynamics of the aerin'a loncephore and magnetosphere, including computer almulotion of specific events and compar tson with ground and establits data. Preference will be given to applicanta having expensace with apace or laboratory plasma physics, and with larga

The second possible position involves analysis of data from Almospharic Explorer and Dynamics Explorer apecacroit Pralarence will be given to applicants having exparience with apace plasmas and with reduction of spacecreft date.

Tile and setary far either position will be arranged, depending on expertance. Please and rasume and bibliography to R. A. Wolf or P. H. Reifl, Dapertment of Space Physics and Astronomy, Rice University, Houston, TX 77001.

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Visiting Scientiat Position The Joint Inelltuts los the Study of the Atmosphose end Ocean, University of Weahington. Visiting scientists with background in almospheric sciences or physical occuring raphy and interests in dynamical and or geosphiomal aspects of climate with doll by Tomi of appendment one (1) year, ronowable for a pacend year subject to the approval of the Council Christy date: Suptember 15, 1981. Send Council Christy date: Suptember 15, 1981. Send Curliculum valua and y bruit research prespectus to Director, JISAO, c o Dopartment of Almospheric Gorances, AK-40 University of Washington, Swallle. WA 28195

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Division of Patroloum Engineering and Appiled Goophysics, Norwogian instituts of Technology, N-7034 Trondheim-NTH, Norway. The above mentianed division has evallable two resourch pasitions on its research project; ament toctonics of the Norwegan continantal

shall . The positions are in only af the categories Saniar Goolagisi Goaphysicisi (Salary Narw cr 119,000 —por yoarl, Geologist-Geophysics [Salary Narw cr. 108,000 —par year], and Junior Geologist Oeophysicist (Salary Narw. cr.

98,000 --- per year)
The project will run over a tour-year period. Appointmonts are made on a yearly basis with possi-bity of extension. Salarlos stated are in Norwegian crowns per year and boloro tax. Non-Scendin cilizons require a work permit. These appointed will collect, compile and interpret reliection genemic, re-traction seismic, well, gravimotric, aeromagnetic, manne magnetic, geological and lineament tectoric data from a large land and offenore area. All posilions require sound queldications in applied gaophysics and geology at university level. Further re-quirements are ability to work independently within an integrated research group and s working knowledge of English which is the working language of the project. The senior position includes responsibilities for the day-to-day activities of the research group and requires several years' previous experiance in ralevant research. There are excellent op-portunities for further studies in geology and geophysics and for tearning Norwegian. All results of the project can be published. Qualified candidates may apply for the status of research student end use results of their research for their theste in par-ital fulliment of the requirements for a doctor's de-gree, subject to approval from the Norwegian Insti-tute of Tachnology, University of Trondhaim, Fur-ther information can be obtained directly from accentric assistant J. Hotha (Tel. 075-94934) or Professor J. Hospers [Tel. 075-94949) et the above memicred Civision, or by letter. Applications includ-ing detailed information on the applicants' qualificafons are to be sent to Prof. Or. J. Hospera at the abova mentioned division as econ as possible. State which postoon the application raters to end

Sodimantologist or Sadimentary Pstrologist University of Celliernis, Senie Barbars. (Correction) Applications are invited for a tanure track appointment in solt rock geology to be filled in 1981–82. Hank dependent on qualifications and experience but preference will be given to the assistant professor level Applicant should normally heve a Ph D. and strong field-orientation and quan-Metive background. The cendidate will be expected to devalop a elrong research program in sedimen-tation. The candidate will also be expected to teach et both undergraduete end graduate levels and in-teract with students and tecutty of the depertment, perticularly in the general areas of diagenesis, volcanic processes, paleomagnetics, as wall as hald geology. Additional duties may include teaching

physical geology and summer field geology. Please sand resume, other documentation o abilities, and four letters of recommandation Saplamber 30, 1981 to Or. Arthur G. Sylv Choirman, Department of Geological Sciences, University of California, Benta Berbara, CA 93106. Telephone (805) 981-3158

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Physical Oceanographer. The New Orleans OCS Office, Bureau of Lend Management, is seeking qualified candidates for a stall oceanographer o supervise contracted merine environme search The primary oracs of research will be phys ical oceanography and meterology. Dubes include: serving as a contracting officer's authorized represerving as a construing enter a authorized repre-sentative, devaloping attidy plans and work state-ments, and advising management on matters within the candidate's area of expertise. Candidate should have a M B. Ph.D. preferred, Grade level: GS-11 or GS-12, salary \$22,488—\$28,951. Responding to announcement no. WO-81-140, send a current SF-121 to assume no later than their St. Section 1 announcement to WC-81-140, send e current SF-171 to arrive no later than Juty 21, 1881 to Person-net Services 1884 I U.S. Department of Interior Bu-reau of Land Management, 18th & C Streets, NW, Washington, D.C. 20240 or call in vertel applica-tion at 202-343-7845.

Postdoctoral Position in Goochemistry/ Cosmoohemistry, University of Arizens. Applications are invited for a postdactoral re-

ociateahlp in the Luner end Plenetary Laboratory at the University of Arizona. The assocista will collaborate with Or William V. Sayntan in ongoing investigations of the refrectory inclusions in conjung investigations of the refrectory inclusions in cerbanacacus chondries. The selected applicant will have major responsibilities to conduct mineral-agical investigations to supplement existing neutron activation enalysis studies. Experience with en alectron microprobe le essentiel; experience with neutron ectivation le desireble. Fecilities include e fully automated SEM/microprobe, numerous gamma-ray detectors including a Compton-suppression apectromater, several computers and a TRIGA re-

ment of research interests, and complets bibliogre-phy, should be sent to Or. William V. Boynton, Lunar and Planetary Laboratory, University of Arizona, Tucson, Arizone 85721. Letters of recommendation, directed as above, should be requested from at least three persons who are well acqueinted with the epplicant's accomplishments end poten-tiel. To receive full consideration, epplication malerials should be received by August 31, 1981. The University of Arizona is en equal opportunity.

Atmospharic Scientist/Group Head. Serio staff scientist position available immediately of the NAIC's Arecibo Observetary. The successful applicent will be appointed as Heed of the Almospher Sciances Group and will be expected to lead that group and to perform independent research using the Aracibo lecilities. A Ph.D. dagrae in almospher ic or physical sciences or radar angineering and a record of solid research eccompliahments are re-quired, Expariance with radar studies of the siralophere, masosphera, end lonoaphera or with HF modifications of the ionosphere is desirable. Salary open. Pleesa eend resume and nemes of et leas hree references to Or. Harold O. Crelt, Jr., Oliec tor, Arecibo Obearvatory, Spece Sciences Suilding. Cornell University, Ithaca, New York 14853. NAIC/Cornell University ere EDE/AAE.

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Institute of Geophysics

The University of Texas et Austin Invites applications for the position of Director of the Institute of Geophysics, e research inetiliute of the University which includes the Gelveston Merine Geophysics Laboretory. The Institute includes programs in merine geophysics, merine geology, solid earth geophysics, eerthquake seismology, lunsr and plenetary seismology, end eeismographic Instrument systems design. The etett numbere epproximstely 110, including e professionel, edministrative end scientific staff of

The Director is responsible for overell research plenning and mensgement, including fiscel monitoring and budgeting; coordination of operations for modern computer tecllities and two deep-ocean research vessels; and interiscing with industriel and egency sponsors and the University edminististion and leculty. Applicants will elso be considered for e concurrent feculty eppointment in the Department of Geological Sciences. The posttion is loceted in Austin.

Applicants should hold a Ph.D. In geology or geophysics, or enother relevent field, and have demonstrated creativity in research and development through publications end other torms of eppropriete documentation. Previous advantation and other torms of eppropriete documentation. ous administrative experience is destrable. The ealery is open. Applications should be received no leter then October 1, 1981. The position will be effective as soon as possible. Please forward explications, curriculum vilse, reterences, and any other supporting materiele to:

> Dr. G. J. Fonkan Vice-President for Academic Affairs and Rasearch The University of Taxas at Austin Main Building #201 Austin, Texas 78712

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vencement] in understending of the deep continental crust. Jeck was a pilme mover in esleblishing the Consortium for Continental Reflection Profiling (COCORP), whose objective is to examine the line structure of the crust and upper mentle, using edvanced reflection techniques. The results to dete heve provided answers to some long-standing problems of crustal delormetion and have given us new insights Into the Ihird dimension of the continental clust.

The Bucher medal is in recognition of outstanding contributions to the basic knowledge of the determation of the aarth's crust. Jack has devoted a mejor part of his carset [to] meking such contributions, using the propagation and attenuation of salsmic wavas; salsmicity and fust motion studies; naw geophyeical lechniquas; even surface geology. He has nuriurad numerous students, many ot whom are also leaders in the field, end [he] has contributed generously of his time to professional societies and committees.

Precident Wilson, the nominating committee for the Waller H. Bucher Medel presents IIs nominee, Dr. Jeck E. Ollver. I have the teeling that this may please you since he helped to write the citellon for the lirst presentation of this madet in 1968 to you.

Charles L. Dreka

Acceptance

I teal very honored, very pleased, and very fortunate to receive the Walter Bucher Medel. Good torlune hes long been e pert of my career: tirst, In the choice of this lescinating occupation of earth science, and then in countless stimuleling and productive interactions with collesgues, essodetes, end, particularly, students. I could not stand here end eccept thie medel without crediting end thenking ell of them. Good tortune elso brought me my fine wile, Gey, who eheree thie honor with me, and two delightful teenage deughtars, who, emong other things, keep my ego in check on occesions like this.

After Meurice Ewing, Weller Bucher wee the professor who most effected my ettitude lowerd earth eclence, end so I am especially pleased to receive his madel, and I would like to tell you a taw stories about him. Probably everyone who ever knew Buchar was infected by his enthusiesm for study of the earth. He was e geologist with little trsining in ics, but he was totally committed to the application of the methods and principles of physics to the study of the

in the tale 1940's, because of this special conviction, he opened his graduate course in structural geology to physics atudents with no previous training in earth aclance, and thei course was my introduction to gaology. It was tough going for me bul probably more ac for Bucher. Whan he used a term like Triassic red beds, there was al lacel one sludeni who didn't know what Triassic maeni, who thought of bede eolely as parts of bedrooms or flowar gardens, end who had never eean any rocks that could truly be described as 'red.' in faci i still heven'il

Once I asked e fallow student whether it was the synclinee or the antisynclines that bowed down. He seld, The word is anticlined, end welked away in disqual. So you can see what Bucher was willing to endure in order to integrets. phyeics end geology.

Bucher's classas ware e source of greet encouragement

for young students. With a curlous mixture of pride and hunillty ha raisled how many of the conclusions of his book on the deformation of the earth's crust hed been proven incorrect by leter observations. In the process he somehow laft us completely convinced thei il was not only our opporturity but our destiny to make new kinde of observations and so to discover the ullimete geologic truths.

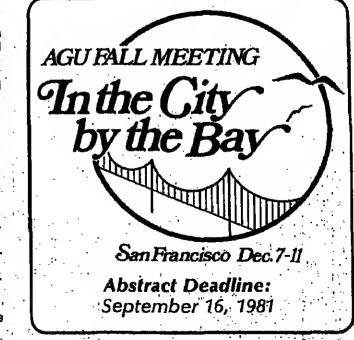
Later on I took Buchar's eeminer in lacionics. At that time he was enthralled by the potential of merine geophysical

studies of the ocean basins, and he dreamed of similar surveys of the continents. Sometimes more enthusiastic than quactical, he once proposed that o balloonist might drift over the Alps, reading a gravimeter and magnelometer and throwing out explosive charges to be recorded by a balloonboune seismograph! The class, perhaps fearful of starting World War III, discouraged him on this point. However. elthough I can't be cartain, that discussion may have been the start of the COCORP project.

Once in the 1950's Lester King, the well-known South African proponent of continental drift, visited Columbia to give e seminal on that subject. His presentation was set up as a debata between King and Bucher, who represented the lixists. Much to his credit, Buchar, Intentionally I am sure. geve e very week defense of the lixist position. King thus 'won' the dabate handily. As a result, the graduate student body was stimulated for months over the possibility of continental drift. It was many years before most of us returned to thei position, but had he lived, none would have been more delighted than Bucher by the coming of plete lecton-

Atter Buchet telirad from Columbie ha took a position with Humble and was seen only infrequently by former coileagues. One evening during thel period, as I was walking home from Lamont elong e back roed, e car pessed me at fairly high speed. When the driver, who was Bucher, recognized me, the cer ekidded to e halt in e cloud of dust end becked up quickly to where I was. I hedn't seen him in yeere, so when he seld 'Hello, Jeck. How ere you?,' I thought it nice that he wanted to renew our friendship. However, before I could answer thei simple and cordial question, he fired off a technical one: 'Heve there been eny deep eerthquekes beneath liely lelety?' Well there hed been, eo I begen e sentence with thet information. After half e dozen words that conveyed the meening, he interrupted with a heerty 'Thank you!' Immediately the car ened off, leeving me stending in enother cloud of duel, with my eyes following that unusuel men who was always on fire with enthusiasm for the study of the earth end who ignited thet aema fire in everyone he encountered. I think thet wes the fest time I sew Weiter Bucher, and thei is the wey I like to remember him.

Jack Oliver



#### Call for Papers: Chapman Conference

A Chapman Conference on Reinfoll Ratea will be held in Urbana, Illinoie, April 27-29, 1982. Convened by D. M. Hershlield, the conference seeks to bring together an interdieciplinary group for an interchenge of idees on current reaeerch end to oulline future research and instrumentation needs. The information to be presented at the conference will be of volue to scientists and engineers in the helds of communications, space technology, almospheric remole sensing, cloud physics, airplane salety, and others interested in very intense, short duration reinfall. The conterence is cosponsored by the American Geophysical Union Precipitation Committee. The American Metoorological Society Committee on Meteorological Aspects of Aorospace Systems, the American Meteorological Society Radar Committee. and the Netional Aeronautics and Space Administrollon.

#### Sessions Planned

Atmospheric physics ns related to raintalt processes. Measuremont: mnss (lipping bucket), photoelectric, magnello, and romole methods.

Models: physical, mathematical, and statistical. Applications; point, eree, quasihorizontel path, surface, Iroposphere, and strelosphere.

#### Formal and Abstracts

The conterence will lest 3 days and will consiet of both Invited and contributed papers. To ensure edequete time for discussion, poster seecione may be used. Persons interested in ettending should aend their neme, address, phone number, and reasons for wanting to attend to AGU. To eubmit en abstract, lollow the format published for the AGU tell meeting (see page 566 of Eos, June 30, 1981). For submittal informetion, you need only to indicate the neme of the meeting and the type of precentation. There will be no ebstract charge. Send abetrecte to Meetings, AGU, 2000 Fiorida Avenue, N.W., Weshington, D.C. 20009. Deadlins for abstracts is December 21, 1981.

#### Student Travel

A Chapman grant covering partial travel expenses will be evailable to one or two aludents who will be attending the

conference. To epply, write to AGU, giving your educations ba kground, your reasons for wanting to attend the conferen e, and your current interests. The awardeee will be se lected by AGU in conjunction with the program committee Deedline for trevel application is November 30, 1981.

#### Program Committee

David M. Hershfleid (Chelrmen), U.S. Dept. Agriculture, SEA/AR, Hydrology Lab., Rm. 139, Bldg. 007, BARC/West Beltsville, MD 20705; telephone: (Commercial) 301/344. 3490, (FTS) 344-3490.

Dougles Greene, Hydrologic Research Leboretory, Office ol Hydrology -OA/W23, 8080 13th St., Silver Spring, MD 20910; telephone: 301/427-7819.

S. H. Lin, Bell Laboretoriea, Rm. WB 1A-227, Holmdel, NJ 07733; telephone: 201/870-7445. John L. Vogel, Atmos. Sci. Section, Illinois State Waler

Survey, Box 232, Urbane, IL 61801; telephone: 217/333-Arnold Court, Cellfornie State University-Northridge,

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### Aeronomy

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## **Exploration Geophysics**

OPRO Magnaffe sed electrical methods IMAXED POLABYASTON IN CLESTRINATED BULYIOS ORES CONTAINSING FLUMGATED REMERLALIFATION J. Wong (Department of Physica, Unitracify of Toronio, Totonio, Oni., Capels NOS IAJ) O. M.

J, theng (bepearsent of Physics, Univacely of Turesto, Forenia, Onl., Coesia KS LAT) C. M. Stanguay
A disseminated sulfide one is represented by a two-component spains in which marsiffnelly conducting irolate aphanoidal particles faintedly confirmed attending the substantial particles and incomplete in allected particles are substantially actions describing the spatial and frequency degendance of a form and custom and in the effect byte pear the sythese of a particle are solved in prolets aphanoidal concisionates. Expressions for the Inquesty-dependent dipals moment indiced on the pasticle of the section of the particle are spansived from the substantial beaming conditions cultant to a sectional spatial at the long sain of the particle are found by examining beaminy conditions cultant to a sectrochemical charge transfer hauses the satellite particle and the cleance spatial case to specify a section of the satellite and the offective conductivity specifies of the misture as a static of the satellite than the offective conductivity specifies of the misture as a static of the satellite and the satellite is satellited for the satellites of the satellites and particles. Examples of formitties as a static of the satellites and particles are presented, on a constructivity specifies are presented. Incurporation and also stated particles are presented, and deposition on all attacks with appropriate experiences of appropriate and deposition of a second constructivity and deposition of the satellite state and deposition of the satellites and appropriate experiences of the satellites and deposition of the satellites and appropriate experiences and deposition of the satellites and appropriate experiences and deposition of the satellites and appropriate experiences and deposition of the satellites and appropriate experiences.

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TRASSIRTY RESPONSE OR AN IMPUCTION LOGGING TOOL TH
A BORROLE
See O930 Instruments
W. C. Chas (Scifundarger-Doil Conserch, P.C. Box
101, Sidgafield, CT 008171 s. J. Rapito
The long time transliter fvertical magnetis dipolal
lotated in a wellbore surrounded by a homogeneous
formatics. A simple signal based on the difforence
between the voltage nulls in a pair of receiver
colls which are displaced vertically from the transmilter olong tie sais of the velibote. A justification of those results in provided by means of a direst numerical integration (Jouble Pourier Iransloration and also two separate approximate approaches.
GEOPHESICS, vol. 40, no. 9

092P Magnetic and electrical methods MULTIPREQUENCY YURAN MYASUREMENTS OVER A SULFICE

092P Magnetic and sloctrical mathods
MARTIPEQUENCY YURAN MEASUREMENTS OVER A SULFIGE
PROPRIT
H. Poldar (Mathomal Geophysical Research Institute,
Uppal Soad, Hydershad 500 007, India)
A six-frequency electromagnetic IPMI system has
been developed and used for a Turan-type survey
over the sulfide deposit of Bailarso copper belt in
Andria Pradesh, india. Turan field attempth ratio
17591 and phase difference 1971 are measured in the
range 84 to 2088 Hz. Sulfides in this best occur as
thin concentrated below which grade into disseminations. Sott covers a major part of the area, interprotection of the results is carried out using a
thin sheet model in free space. Recovers, an attempt
has been made to account for finite resintivity of
the normal ground by computing Turan response of a
conducting half-apace appropriate for the area and
subtracting the same from the observed teaponne.
The results of the survey could be though advantage of the Turan cethod, viz., its grunter depth
of investigation compared to a method life Silingram.
Due recent ground at Halfarao is only middly comducting to list the free-mir approximation is walld
at the frequencies, a correction for the finite restructure of the ground for required only at high
tropoundies. However, the listation of a singlelock interpretation where for the hedroof
confuctor is well brought out by the results.

0910 Magnacle and sincerical bathods A NEW TECHNIQUE FOR LATERED EARTH MAGNETOTELLURIC

Investors
J. C. Laraso (U. S. Deparczent of Commerce, Matlonal
Ocamic and Atosopheric Administration, Parific
Marine Environmental Laboratory, 1711 - 15th Ave.
M.E., Seattle, VA 48105) M.E., Seattle, W. 48105)

A new one-disensional (1-0) Inverse method for layered-march interpretation of magnaccellurfe (MT) tempones curves is beasd on the method of Schmeler (1972). It involves transforming the Fover S reapones into a mondisensional tomplex Logarithm response, computing the partial derivativas from a new eigerithm for the logarithm response, and iteracivally solving (by damped items quartes) for the logarithm of the conductivity contians between layers. Error base for the layers conductivities are taximated by a staple application of propagation of errors assuming random and independent response arrors. Becken-Gilbert type emoditing kernels are also computed in order to appetly the upper and lower depth limits on the conductivity model and to examine whether the layer conductivities are locally averaged values. The tannels are found to be an important aid in model interprelation and emphanize the fact that layer conductivities are neverages. The relied in foods interpretation are reverages. The relied in fact that uning artificial and real dots.

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OTHER SHEET METHODS
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O'10 Selumic methods
A SEW DISSAIBUTED CHARGE
M. f. Armold (SIE East 29th St., Tufsa, OK 74114)
J. W. Maylett
A new type of distributed charge intended to he administration outcome in samples of lasp charges, locked in a shallodg at unifers typesed separations, competed by a time-delay from. The lime-delay functioning rapius for appropriate language of fissay daton-delay at ing rapius for a Planting") in contact with a non-delay from the last of separation of the last of fissay daton-delay fines delagrator (Moosi"). Normi for monolectrical delay datonator (moosi"). Normi for Moolectrical delay and serkating Moosi-based (moosi-controlled datonator). It controlled the moolectrical delay and serkating Moosi-based (moosi-controlled datonator). It controlled the moolectrical delay and serkating Moosi-based (moosi-controlled datonator). It colled the moolectrical datonator (moosi-controlled datonator). It colled the moolectrical datonator (moosi-controlled datonator).

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It is being leaded to quantified.

performed in central louisiana aboved that III dis-tributed charges increase the signal-to-noise IVEN ratio relative to that yielded by concentrated charges by robe ing shot-personated surface poles, (2) distributed shatpes increase the maple tra-quency content over that yielded by angentated charges, and the relitable and errolated intentialistical richarge can be constructed with Sonel Ericadel delay cord. delay gord, GOONYSIES, v. 46, ga. 9

DOLG Bolemic methods RECOMBTRUCTION OF A SPADSE SPEED ITALS FROM A P.G. TION OF ITS SPECTRUM AND APPLICATION TO MICH-RESOLUTION DECONVOLUTION

TION OP ITS SPECTRUM AND APPLICATION TO RICH-RESOLUTION ECONOMISTION
See 0910 Computer applications
Shinds Lovy Hornerity Department of Leophesica and Astronomy, Polyeculive of Exitain Colombia, Tancourer; presency Mobil 011, Special Applications, Police, TX 752215 Paier F. Fallagar
An algorithm in proposed for the reconstruction of a sparse spike train from an incomplete set of its Fourier compounts, it is shown that as listing as 20-25 percent of the Fourier spectrum is sufficient in practice for a high-quality reconstruction. The mochod employs linear programming to administion of this norm layors seductions with involated application in layors seductions with involated application of the output, became administion of this norm layors seductions with involated application of the deconvolution of only of morganic when the desired output is a sparse apika series. Relative to instructions for the uniform spike amplicates are included in the calculation of the spife series. Equations for the uniform spike amplicates are solved to an accuracy compatible with the uncertaints in the rollable data. In examples with 10 percent random noise, the output is amperior to that obtained using conventional issue-aquaros techniques.

0930 Selsoic mothoda
ERROR ESTIMATES FOR ISVERSE NODELING SCHEMES GRING
SETSMIC TRAVELTIMES
See 0910 Computer applications
Pjárn Ursin (SINTEP, Civision of Patrolaum Technology, N-7034, Trondhels-2711, Norvayf
Oliforent nuchods for estimating parameters is a
layoted geolopic model are discussed. Traveltime
parameters, ontineed from setant date, are used
to entimate the layor parameters doffning the velocliv lunction in each layer and the interlaces
between the lovers.

liv lunction in each layer and the invariance between the lowers.

Solution the lowers, the translation of a standard to consist of a standard monocouriepping reflored guizes and addictive white Gaussian noise. An estimate of the covertance of the travelline parameters is then afver by the invares of Fischer's inforestion matrix as it is shown how the information matrix can be computed theoretically or directly from data. Expressions for the covactance matrix of the layer parameters ate given. The results can be made to compute confidence regions for the estimated parameters.

Optimal solution measurement mysicus are discussing, required in a colorton for designing an aptimal ensisting pulses. The energy of the derivative of the received nignal (the source pulse convolved with the inpulse response of the arch set the forpulse response of the arch set the set the forpulse response of the arch set the forpulse response of the arch set the set the forpulse response of the arch set the set the forpulse response response of the arch set the set th

0999 Canutal or infectifeneous A COMBINATION OF ELECTRICAL RESISTIVITY, SEISTIC REFRACTION, AND GRAVITY REASUREMENTS FOR GROUND-CLUBB STATE OF THE SEISTING SEASON.

A COMMINATION OF ELECTRICAL RESISTIVITI, SAINTER EXPLORATION, AND GRAVITY MEASUREMENTS FOR GROUND-WATER EXPLORATION IN SIMAN See 2205 Africe

Romaid A. van Overmearan (Groundwater Survey TBO, P. O. Sox 255, 2500 AF Delft, The Natherlands)

In the asymmeh befor of contral Sudes, sear the town of Keatf, e regionsf geophysical survey has been carried out forming pare of e groundwater project. Because of the presence of delectable and significant contrasts in physical properties of the subsell, integrated use could be made of slattlight tashedil, integrated use could be made of slattlight tashedil, integrated use could be made of slattlight to the integrated use could be made of slattlight soundles curves, additional subservate afactical soundles curves, additional subservate and sephysical vell fogs is normally a necessity for solvies called the state of the subsell fogs is normally a necessity for solvies called the state of the subselling of the subselling to the subselling the solvies of the subselling the solvies of the subselling the subs cal well fogs is normally a necessity for solving the problems of equivolence. Along a profile in the nestern part of the area studied, where additional society part of the area studied, where sertices subsurface information mes scarce, it wastless electrical soundings have been made. A preliminary slople sethematical interpretation suggested presibilities for the progence of teach groundwater in the searcern part of the profile. No original control of the profile of th the equivalence problem, suisals refrection work was carried out at some celested plans; that yield additions! information on depths to bedrock. These splends does need possible a united solution of the electrical mounding carves, from which is a could be exceeded that all proundwater in the area is sailed subsequent test drilling confirmed that it is always.

is sailes. Subsequent test drilling confirmed thank liedings.

A regional refetive horguer amonaly map provided a ploture of the general geologic acroduces and make possible, rough escimates of depths to before, the same provided as ploture of the general geologic acroduces and make possible, rough escimates of depths to before, the same provided the s

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J. Caphys. Fos., Green, Paper 100917

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chessity of Calgary, Calgary, Alberta, TTR 184 calls E. Rachienhache

Magta Isotope racios of hydrochermally stated bearing from depths up to 3 ha are crited from 3 lacelities in Icaland: ill Smiry faternational Benearth Orliling Project wis to extent icaland; whose rock of 50,40.4 to 24.40 Seos, (ffl Pife-Pleistocaee basel) to Spitavik, 44.3 to 40.858, (ffl) Rolocene innit from Kraila cantral volcano, -1.4 to -10.5to 7s values to the deeper portion at Kraila are the least aver raported. All the acaptam were effected by network hydrochermal accivity at 300 to 20 could different water fock waters. The result accident and the second state of the 10.5to 150 could be seen a second in the 10.5to 150 could different water fock waters. The relative circulation of motoric water at Kraila 14 cased arrong subsolidus deplacion of 160 could fock to 150 could be 1 . Capbys. Res., Red. Paper 181014

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Fiver to compleme until eviduation. (100,110,
710 witch, occasic crust). f. Chaphys. Res., Led. Paper 180894

# Hydrology

fill Evaporation

GHATIOMAL RETHATES BY LAKE SUFERIOR EVAPORATION

MIP ON FITCH FIRDING

1. Darecti (Geast Lakes Environmental Research
Impracey, MOAA, Am Arbor, Ktchigao Aglob)

Sorphy apporation from Lake Superior was

destroiced for follwidual years of a 34-year

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with the vater budger seasonal distribution and annual values. thysporation, ness transfer, hydrology, ice cover).

1125 Gleciology
YLON LAW YOU POLICEREMALTHY ICE IM GLACIERS:
COMPARISON OF TREGGETICAL PRESCRIPTS, IABORATORC DATA, AND YTHIO REMAUSIBINES
Super Leg. Socke [Department of Geology and
Geoffysics, Salversity of Minnesote, Minnesote,
polis, NW 55455t

polis, NR 55a5c

Theoretize incolderations, laboratory exper-leants, and limited field date support a value of 3 for the apporent n in the commonly ruthed expirised flow law, \$\hat{c} = (\text{VSI}^n\), relating stress and strein rate in polycytelatine ics. It this value is excepted, the viscosity parameter, B, can be determined for a wide variety of experi-ments.

Bents.
In a plot of Log B against reciprocal temperature, points scaller about a line defined by an applical equation of Lie form:  $B = S_0 \exp\left(\frac{T_0}{T} - \frac{C}{(T_0 - T)^4}\right)$ 

$$B = \frac{\pi}{2} \operatorname{orb} \left\{ \frac{1}{L^2} - \frac{C}{L^2 - L^2} \right\}$$

Bas of T - Trail |

where T is the temperature is knivin, and B, C,
I, and f are empirically determined contains.

For Laboratory data the section is equivalent to approximately a factor of 5 variation in train relations and imperature. The cause of this variation is true and temperature. The cause of this variation is unthear, but patages results from any single laboratory are generally internally taccinisms, caspie organization procedures should be ctudied.

Yield truetisms yield values of 8 that are systematically higher than laboratory regults. Thus natural ice appears correspond than laboratory is, decplie the coarcer testure and the presents of an aperopht fabrics in the natural ice, both of with should lend to soften it. In addition natural ice in placters appears corresponded to the natural incommendation of the stress is systematically overestimated in field studies, or that a flow law beard on the non-Hiers yield criterion (or second invariant of the stress description of the dolarnation of tee in cultivatal circus listes.

INTO Boll molecure
Discalation of Equilibrium CHMMISTRY DUPIES
YRANSIENI SOLUTI TRANSPOPI
L. H. Budley, D. J. Magement (Dept. Soll Science and Bloose, Deah State Univ., Legom, UT 61121, and J. J. Jurinah.
A field upperiment was conducted to assess the reliability of a soll-water and equilibrium chestative simulation model. The deterministic model considers one-disamsional water five and solute transport represented by the Dark equation and miscible displacement theory. Soil chemical reactions include the procepitation and dissolution of line and gypsuo, and sine cation exclude reactions include the procepitation and dissolution of line and gypsuo, and sine cation excludes. It was abstracted that the model provided reasonably accurate simulation of electrical conductivity during transfers transport under cropped cases. This was attributed to an apparant homogenization on water and water thace by the activity of plant root extraction. This indicates that the use of single-valued telactionspip in this model to describe water and solute flow is an acceptable practice to does the cropped cases, but that other modeling approaches should be developed for non-cropped cases.

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Tide Mater quality
METHODS OF DISCHARGE COMPENSATION AS AN AID TO
METHODS OF DISCHARGE COMPENSATION AS AN AID TO
METHOD METHOD OF MATER-QUALITY IMPMS
D. Harned MU.S. Leological Survey, B.O. Box 2857.
Raielgh, North Carolina, 218P2, U.S.A.I t. bunish
Lit, J. Crawlord Iti, J. Crawford for compensating for discharge two new methods for compensating for discharge manner evaluating twends in water-quality data use long-term discharge re-ords as the base tor data adjuntumnt. One nethod, discharge normalization, adjusts darly discharge using a central value calculated for the period of record, and residuates daily specific conductance from the adjusted discharges and discharge wersus appellic conductance regressions. Sormalized conceptrations described by a formal conductance regressions. justed discharges and discharge versus apacilic conductance regressions. Sormalized concentrations for many constituents can then be calculated from linear relationships between specific conductance and constituent concentrations. The accord cathod, discharge-frequency weighting, weighte each observed concentration by a lraction of the total area undermeath the discharge-frequency distribution for the period of record. While fraction is determined using the atreas discharge at the time of mampling and the discharge-frequency distribution for the period of record. The weighted concentrations are numbed for each veer. Both morralized values and weighted values can be plotted agoinst the to produce trands observing the product rends consentially independent from discharge effects. Results from the rethods are numbed for other trend-delication techniques. I from other trend-delication techniques. I from other trend-delication techniques. I from the trend-delication techniques. Water Resour. Res., Paper 18091P

3180 VALUE QUALITY NITHOGEN AND CARBON SOLUTION CHEMISTRY OF AN OLD-GROWIS CONTYROUS POLITY WATERSHED SEPORE AND AFTES CUTTING P. Solling (Formet Sefence Department, Ocegon Scate University, Catvallis, Oragon) and F. H.

Scate University, Catvaille, Oragon) and F. H.

McCorlaon

Clasolved Sjeldahi H and nitrate consatrations
were conitored for 1 to 7 years before and for 8
years after clearcuting of a 10.2 be, Douglas-fit
dominated vectorabed in the Pragon Cascade
Mountains. Dissolved organia 6 (900) and assemblus
concentrations wass sonitored after carting. We
sampled throughfail, litter leachate, sod soil
solution (at fout depths is and below the rooting
sons) at low locations along a transact up and
down the slope. We also assepted precipitation,
streeswater, and seepage unter. A Alta just off
of the waterabed served as the control for afi
nostitons in the wear profile except for afreeveter, for which a stallat, maneby watecashed was
the costical. Objectives were 1) to document
effects of clearcutting on so lution chastatty and
2) co provide deca itom which to calculate docagaing nutrienc cycling budgets before and afret
cutting.

agains nutrient cycling angular custing.
Seginning Y ca 16 months after clearcuttips, of treta concentrations increased I to 100 times no other cut watersked but remained mantly pockanged so an adjacent, unsut, control area. Lacrenase water greated at 8.0-a depth than at other positions greated at 8.0-a depth than at other positions along the water profile and later in seepas sod at casewatet. Greatest nitrate levels were detected meat the becton of the alogs. At the uppartment alta, about 30 e belon the ridgatop, nitrate valvas tensined the sees as at the control alta.

upparmont alta, another properson as at the control nitreas wives resained tis sens as at the control nitreas wives resained tis item them there of secondary increased such lais than these of secondary increased such lais than these of secondary in the nitrease concentrations at most progenitar than nitrease concentrations at most progenitar than nitrease accordance of alta cutting. Stron effort metching, aftered doctanated only at the secondary of the secondar

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# Meteorology

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The distribution of the oxides of intergen (MO<sub>2</sub>) in the troposphere is the most critical parameter for understanding the photochestical component of the tropospheric ogene cycle. Recent gradies have suggested that the tropospheric distribution of MO<sub>2</sub> is controlled by transparity processes where the primary MO<sub>2</sub> owners to outlies the state of the primary MO<sub>2</sub> owners to outlies the state of the primary MO<sub>2</sub> owners and the laboration of MO<sub>2</sub> is controlled by the state of the primary MO<sub>2</sub> owners and the laboration of the process of the pr a deline lightights rie inconsistenties of such a rassitant 80 distribution with the measurement of 80 is the derinant Mesiapher addistribution and by couparing the magnitude of the stratu-apheric 80 source with the amount of 10 ballowed to emonate from lightning and afthropogunic noutces. J. Gaophys. Ses., Grees, Paper 100974

372P Clearology GLOBAL GRONE LONG-TEPM TRENDS FROM EATELSHIR NEASSPERENT AND THE SPEYONER TO SOLAR ACTIVITY VARIATIONS

WASARREMAN AND THE REPORT TO SOLAR ACTIVITY WASIATIOS

G. H. Yearing (MAIA Lenginy Secarch Conter, Hampton, Virginial L. S. Lehe, J. T. Hicholmon ffi and M. Feterajan

Analysis of global peons veriations for the paried 4/f0-12/71 was perforced using the reprocessed Sirbus A backstationed ultraviole: [Suvi pessurerents of total otene. A certolation coofficient of 0.97 is found between the 6-renth running cean of global mean istel acone Iffitored for weak semigenously, annual and quasibtential variations) and the 10.7 on solar ectivity In-Man-Cortecting come for a time-September Intividual bias telative to Dobgen areas measurements reduced to 1 to 12 the global mean come veriation acert the solar cycle. The solar ultraviolet variability required in a 10 time-dependent intividual variability photochosical model to account for the wheetwood ozons variation appeals to be cossistent with recent solar UV observations.

J. Googhya, Rea., Green, Yaper Irunal

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C.b. Rodgers and A.J. Franchiseparthent of Almone allon in the temperature measurements this by the simbus 5  $\odot$  R and Minbus 6  $1^{100}$  instruments. The wave has largest amplitude in the remain one of low factories of the number hemisphere and has low lattices of the square mentioners and has antively aspirostrical negislated fluctuation. It is supposed that the wave cay be an enternal Possily wave or free wave similar to the Soley wave, the springed Structure shows little phase this and a slight indication of an increase an amplitude with height. Here waves, 2-day wave, rotational waves, tracalling waves, 1. Geophys. Sas., Green, Yaper Livest, 1745 Geavity waves, tides, and compressional WAVES INERTIO-GRAVITY WAVE INDUCED ACCELL-RATIOUS OF MEAN FLOW HAVING AN IM-

INERTIO-GRAVITY WAVE INDICED ACCELE.
RATIOIS OF MEAR FLOW HAVING AN HITHOSED PEPIODIC COMPONENT: HIP-LICATRUIS FOR TIDAL OBSERVATIONS IN THE
MATEON REGION
R. L. Baltorached The Assospace Corporation, Space Scences Laboratory, P. O. Hos.
92:57. Los Angeles, CA 900091
The sentidurnal horizonte reliberage at day
to-day variability in amplitude and phane. In
eduction, the variability appears to be substanliably local and random, suggesting a commention
will gravity wave activity. We suggest that a
eignificant contribution to the observed settydiurnal harmonic at incleor heights might result
from sectio-gravity wave induced accelerations
of the mean tides. The rate of wave forcing of
the mean wind to related to the frapplers-shifted
wave frequency, so that during alternate phases
of an imposed mean wind oscillation, interactions
will have which accelerate the mean wind an
opposite sensor may be lavored. How the imposed uses wind may modulate the mean-line
wave sulch accelerate the mean wind in
opposite sensor may be lavored. How the imposed uses wind may modulate the mean-line
wave sulch accelerate the mean wind in
opposite sensor may be lavored. How the imtion is a manifestation of the modulation of the
interaction process by the soundinanal tide. The
variability of the considernal harmonic would then
reflect the local variability of mortogravity wave fluctualities, and also constinuer
feedback on the waves. Calculations with a
simple fine-dependent wave mean-line invaded
tradisate that a wave induced component of the
senidismal harmonic with amplitudes comporable to the senidional tide stuff to pessalid.

1. Geophyc. Set., Greth, Paper 10-921 1, Georbye, Rat , Green, Paper (Co97)

1655 interaction of accomplians with electromag-PROPERTY PAGES

J. I. Marcaif (Engineering Experient Scatton,
Gsugge Tnetitude of Vectoring, Atlanta (A.
10112)

Differential propagation effects are a toy elemont for the design and use of desi-cremel radars
for subsocological measurements. Particularly in
the case of crealisty polarized atamets, there
ellects detended the calcium ranges he which
certain measurement objectives can be accomplieled. Yet various putposes one may wint be
assure either that propagation offects are nogliable or that they dominate backmartering
ellects in the received signils. Appreciate and
easet representations of the averaged signils,
randers and the spectral functions are given for
cases in which propagation effects are given for raraters and the spectral locations are given for cases in which propagation effects are predent-nant. The cross-spectrum of the two receives aiguals and the spectral power ratio can be spel under sure conditions to separate scattering and propagation effects. Mai. 521., Vapor 190122

1100 Physical properties of seasons STATUSPHERIC SUPPLY PROMIES CAPTION EMPTION, 1990 FORTH SHITLES TO THE CARLIEST APPOSED BY A POOPLY (MCLYPRIS)

Volcagic Puriling

W. A. Sellerek, b. J. Bruc, and b. heiben.

While sampling stratespheric actually during daly-August 1910 a prime of trest, volcants debris was observed in the Variablers bestsphere. The origin of this material meson to be a poorly documented explosive eraption of Garelot volcan, in the alleutrac lelands | fbr debrie was sampled at an altitude of 17 2 km - almost curee the height of Observed recuption clouds | Such remote, underswed or poorly documented eruptions may be a source that being majorism the "ambient" stratosphericaroud harbground. (Sullate arrand), volcante eruption, stratospherel Gauptyn, Rea. Lett., Saper 12045

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